

EFFECTS OF ACCESS TO A STIMULATING OBJECT ON INFANT BEHAVIOR DURING TUMMY TIME

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Placing infants in a prone position for “tummy time” often is recommended to ensure appropriate infant development and to combat the effects associated with infants spending extended periods of time in a supine position. However, tummy time may be associated with inappropriate infant behavior such as crying and noncompliance. We provided continuous access to a preferred stimulus to decrease negative vocalizations and to increase the duration of an infant’s head being elevated during tummy time.

Key words: crying, noncompliance, infant behavior, stimulating activity, tummy time

To decrease the risk of sudden infant death syndrome (SIDS), the American Academy of Pediatrics (AAP, 1992) initiated the “Back to Sleep” campaign that promotes infants being placed in a supine sleeping position. Although placement of infants on their backs during sleep has been associated with a reduction in SIDS (Willinger, Hoffman, & Harford, 1994), this positioning also is associated with the development of plagiocephaly (i.e., a flattening of the back or side of the head; Biggs, 2003; Hutchison, Thompson, & Mitchell, 2003) and negative effects on muscle tone (Monterosso, Kristjanson, & Cole, 2002). This, in turn, may be associated with long-term complications such as delays in achieving developmental milestones (Davis, Moon, Sachs, & Ottolini, 1998; Ratliff-Schaub et al., 2001). For example, an infant who spends extensive periods of time supine may have limited opportunities to build the muscles in the neck and shoulders necessary for rolling over, sitting, and crawling.

Given these concerns, pediatricians commonly recommend altering the positioning of infants during periods when the infant is supervised (Mahoney, 2003), including prone placement for “tummy time.” Although such

placement may improve muscle tone, it has been noted that some infants who are not exposed to consistent periods of tummy time or find it challenging become distressed (e.g., cry) when placed prone (Graham, 2006). Infants commonly engage in distress or noncompliance in the form of crying when placed in stressful or aversive situations (Derrickson, Neef, & Cataldo, 1993), which may affect caregivers’ willingness to place the child in such situations (i.e., willingness to conduct tummy time).

Based on the importance of consistent tummy time for infants and the potential for infants to cry and become noncompliant with this activity, it may be necessary to develop procedures to promote appropriate infant behavior during tummy time. Some authors have suggested providing access to preferred toys and stimulating objects in the infant’s field of view (Graham, 2006) that may reduce or counteract any aversive qualities of the activity (i.e., function as an abolishing operation; Lomas, Fisher, & Kelley, 2010). However, this approach has not been evaluated experimentally. In the current case, we systematically evaluated the effects of continuous provision of a preferred object on infant behavior during tummy time.

METHOD

Participant and Setting

Meadow was a 7-month-old girl, born at 33 weeks gestation with no perinatal complications.

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At the time of study, her cognitive development, gross motor skills, and physical growth were typical for infants of her chronological age. Her inclusion in this evaluation was based on caregiver observation of high levels of crying when placed prone on the floor for short periods of time (e.g., 1 min) in combination with low levels of lifting her head off the floor.

All observations were conducted in the child's home. A cloth mat (2 m by 2 m) was placed on top of a rug near the middle of the room. For all observations, Meadow was placed in the center of the mat. Two or three observations occurred daily, and each observation followed either a minimum of a 1-hr nap or 11 hr of night sleep. Two 5-min sessions (based on general recommendations to place an infant in a position for tummy time two to three times per day for 3 to 5 min; AAP, 1992) were conducted during each observation (i.e., four to six sessions were conducted daily), and each 5-min session was separated by a 10-min break. During each break, Meadow was given attention from an observer and was allowed to rest (e.g., she was held or placed in a supine or sitting position on the same mat).

Meadow had been fed and diapered prior to the start of each observation. In addition, observations were not commenced if she already was engaging in negative vocalizations. Finally, during the course of the evaluation, she was not placed in a prone position on the floor outside the observation times (i.e., tummy time occurred only during sessions), nor did she have access to the targeted stimulating object.

Response Measurement and Interobserver Agreement

The dependent measures included the duration of negative vocalizations and elevated head. Negative vocalizations were recorded any time she engaged in crying, whining, or coughing. Qualitatively, the negative vocalizations that occurred would be described primarily as "fussing" as opposed to intense crying and were separated by intermittent pauses throughout

baseline sessions. Elevated head was recorded when no part of Meadow's head was in contact with the mat. Negative vocalizations and elevated head were recorded as duration of occurrence in seconds by starting a computer timer when either behavior began and stopping the timer when either behavior ceased. These measures were converted to a percentage of session (cumulative duration of behavior divided by session duration [300 s], multiplied by 100%), for the purpose of data analysis. All data were collected on laptop computers using a specialized data-collection program, and all sessions were video recorded.

Interobserver agreement on the occurrence of the dependent measures was assessed by having two observers independently but simultaneously collect data during 29% of all sessions. Interobserver agreement for each session was calculated using partial agreement within 10-s intervals. That is, for each 10-s interval, x represented the smaller value divided by the larger value, and the mean of all x values was calculated and multiplied by 100%. These data then were summed across sessions. Mean interobserver agreement was 84% (range, 81% to 87%) for negative vocalizations and 82% (range, 74% to 90%) for elevated head.

Procedure and Design

Prior to the treatment analysis, a preferred object was identified from an array of potential items (Roane, Vollmer, Ringdahl, & Marcus, 1998). Meadow was seated on the floor with six items within arm's reach (items were included based on parental observations of interaction), and data were collected on the length of time that she touched or held an item or looked in the direction of the video. The results of this assessment suggested that a video designed for infants played on a separate laptop computer screen (30 cm by 20 cm) was the most preferred item.

All baseline and treatment sessions began with the observer saying "tummy time" while placing Meadow in a prone position with both hands in contact with the floor under her upper torso (i.e., slightly under and to the right and

left of her sternum). During baseline, no objects were within reach or sight, and Meadow was placed in front of a white backdrop (approximately 60 cm from the top of her head). The observers did not respond if she engaged in either negative vocalizations or elevated head, and attention was not delivered until the end of the 5-min session (as described above). During all observations, an adult observer was in clear view of Meadow and was available to intervene in the event of any unsafe or worrisome situation. Treatment was conducted in a manner identical to baseline except that a video screen was positioned approximately 60 cm from the top of her head and the preferred video played throughout the 5-min session. The effects of the two conditions on the occurrence of negative vocalizations and elevated head were evaluated using a reversal (ABAB) design.

RESULTS AND DISCUSSION

The results of the treatment analysis are depicted in Figure 1. During the initial baseline, the mean percentage of session with negative vocalizations was 74.8%, and the mean percentage of session with elevated head was 28.1%. When the treatment was introduced, negative vocalizations immediately decreased to zero, and the mean percentage of session with elevated head increased to 81.7%. A return to baseline resulted in an increase in the mean percentage of session with negative vocalizations (53.9%) and a decrease in the mean percentage of session with elevated head (52.2%). Finally, when the treatment was reimplemented, negative vocalizations again decreased to zero, and the mean percentage of session with elevated head increased (83.6%).

Previous research has suggested that altering infant positioning during periods of wakefulness is recommended for offsetting the negative side effects associated with supine sleeping. The data obtained with this child suggested that she was likely to engage in relatively high levels of negative vocalizations and was unlikely to raise

her head for extended periods of time unless presented with a stimulating object. Thus, the current results demonstrated that access to a preferred activity significantly reduced levels of negative vocalizations, suggesting that tummy time was less aversive during the treatment condition. It is possible that the continuous provision of a preferred stimulus lessened the aversive aspects of tummy time (i.e., an abolishing operation; e.g., Lomas et al., 2010). A similar approach has been used to address compliance during other pediatric medical procedures such as magnetic resonance imaging and dental examinations (e.g., Slifer, Cataldo, Cataldo, Llorente, & Gerson, 1993; Stark et al., 1989). It is possible that the use of noncontingent access to preferred stimulation might not affect infant behavior positively during tummy time. In such cases, an alternative approach might be necessary (e.g., graduated exposure to an aversive context; e.g., Shabani & Fisher, 2006).

The current case report is limited in that the treatment involved continuous access to an object, specifically a preferred video, that may be undesirable for some caregivers and health-care providers (Christakas, Zimmerman, DiGiuseppe, & McCarty, 2004). Alternative, developmentally appropriate stimuli (e.g., a mirror, a visual or auditory toy) may produce similar effects. Second, this report involved only one participant, which limits the generality of the results. Aside from these limitations, the current outcomes may affect caregivers' willingness to expose their child to tummy time. That is, decreasing levels of negative vocalizations during tummy time also may increase the frequency and duration that caregivers implement tummy time with their child. For caregivers, terminating tummy time may be reinforced negatively by the cessation of infant crying and whining. Previous research (Piazza et al., 2003) has shown that caregivers may avoid putting children in a seemingly aversive situation because of the negative side effects for the child (e.g., crying) or the hypothesized

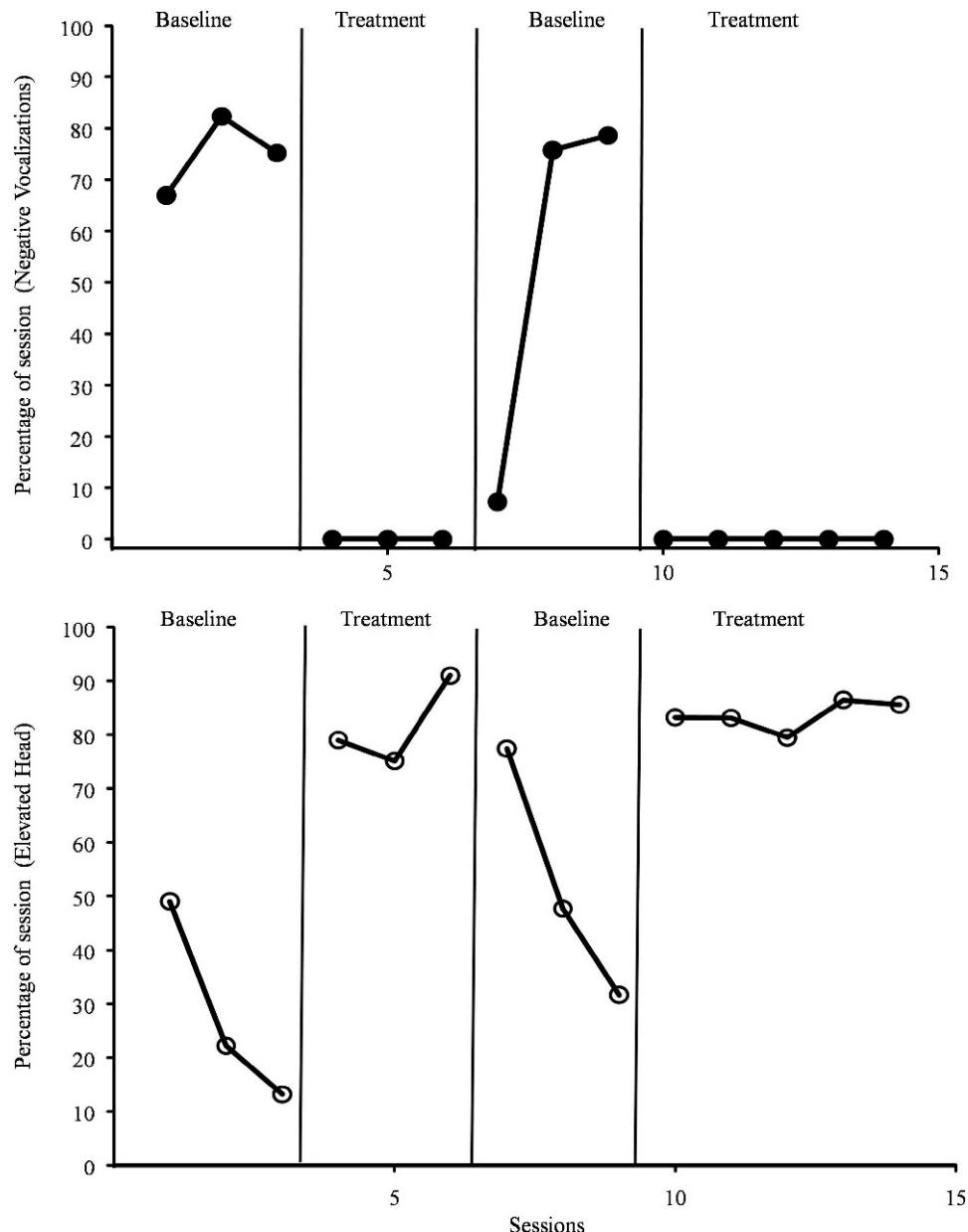


Figure 1. Percentage of session with negative vocalizations (top) and percentage of session with elevated head (bottom) during the baseline and treatment conditions.

effects this interaction may have on the relationship with the child. Consequently, caregivers may forgo these activities, which may ultimately worsen the child's behavior (e.g., reinforce crying) in this context and place them at risk for plagiocephaly or delays in achieving developmental milestones.

An alternative explanation for the obtained results may be that Meadow could only access all of the stimulation produced from the video if she engaged in the elevated head response (although she could hear music from the video regardless of how her head was positioned). The current data suggest that holding her head up

may have been less of a skill deficit and more of a lack of sufficient motivation. However, Meadow spent longer periods of time holding her head up when the video was playing, thus increasing the opportunity for her to strengthen muscles necessary for further development. Finally, the current results demonstrate the utility of applying behavior-analytic principles and research strategies to address health-care compliance in pediatric populations.

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